TECHNICAL UNIVERSITY OF MALAYSIA MALACCA

An Analysis On Facility Layout Using Systematic Layout Planning: Case Study In Lighting Manufacturer

Report submitted in accordance with the requirements of the National Technical University of Malaysia Malacca for the Degree of Bachelor of Engineering (Honors) Manufacturing (Management)

By

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JUDUL: **AN ANALYSIS ON FACILITY LAYOUT USING SYSTEMATIC LAYOUT PLANNING: CASE STUDY IN LIGHTING MANUFACTURER**

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APPROVAL

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DECLARATION

I hereby, declare this report entitled "An Analysis On Facility Layout Using Systematic Layout Planning: Case Study In Lighting Manufacturer" is the result of my own research except as cited in the references.

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ABSTRACT

In the globalization market, saving cost has become a very important issue in manufacturing industry. The facility layout is one of the important studies that give a significant advantage to the operation activities in order to reduce the operation costs and increase productivity to keep its competitiveness in the market. An effective facility layout can reduce the operation costs because it influences many activities in manufacturing system such as material handling, utilization of space, operating costs, and so on. This project presents an analysis on a facility layout of a lighting manufacturing factory called PCO. LITE Electrical Sdn. Bhd. located in Perak, Malaysia by using Muther's Systematic Layout Planning (SLP) procedures as an approach to solve the PCO layout design problem. The alternative layout was developed in this project based on minimum distance traveled between each pair of department. It improved the company existing layout by reduced total movement traveled in production for material handling, and then provides some recommendations for improvement to the layout. The measurements covered the actual sizes of the layout and departments, activities between departments, distance between departments, and material flow between departments in the factory visit. Besides that, the field observations and interview to supervisors in the factory were carried to gather valuable data for this project. The proposed procedure is illustrated to be a viable approach for solving layout design problem through a real-world case study.

ABSTRAK

DI dalam pasaran globalisasi, menjimatkan kos sudah menjadi satu perkara yang sangat penting di dalam industri pembuatan. “Facility Layout” adalah salah satu pengajian penting yang menberi kelebihan istimewa kepada aktiviti operasi untuk mengurangkan kos opearsi dan meningkatkan penghasilan untuk mengekalkan daya persaingan di dalam pasaran. Satu “Facility Layout” yang berkesan boleh mengurangkan kos opearsi kerana dapat mengaruh banyak activiti dalam sistem pembuatan seperti “material Handling”, kawasan penggunaan, kos operasi, dan lain-lain. Projek ini memperkenalkan satu analisa terhadap “Facility Layout” dengan menggunakan cara “Muther’s Systematic Layout Planning (SLP)” di kilang pembuatan lampu namanya ialah PCO. LITE Electrical Sdn. Bhd. terletak di perak, Malaysia untuk menyelesaikan masalah reka “Facility Layout” PCO. Ikhtiar lain diperkenalkan di dalam projek ini berdasar kepada minima jarak bergerak di antara pasangan “department”. Ikhtiar telah menperbaiki “Facility Layout” syarikat tersebut dengan mengurangkan jumlah pergerakan di dalam produksi untuk aktiviti “material handling” dan memberikan cadangan untuk memajuan “layout”. Ukuran di dalam kilang meliputi saiz sebenarnya di dalam “layout” dan “department”, aktiviti di antara “department”, jarak di antara “department”, dan “material Handling” di antara “department”. Selain itu, pemerhatian di dalam kilang dan temuduga dengan “supervisors” di dalam kilang telah dijalankan untuk mendapatkan data yang berguna kepada projek ini. Cara yang dicadang telah digambarkan dan menunjukan berkesan untuk meyelesaikan “layout” melalui “real-world case study”.

DEDICATION

For my family

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LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE

CT	-	Cutting
BEN	-	Bending
ST	-	Stamping
SW	-	Spot Welding
PA	-	Painting
VAR	-	Varnishing
RV	-	Rivet
DD	-	Deep Draw
DRIL	-	Drilling
TAP	-	Tapping
WEL	-	Welding
PP	-	Power Press
COW	-	Copper Wire
PF	-	Polyester Film
CEC	-	Copper End Cap
BC	-	Base Cover
CON	-	Connector
CW	-	Coil Winding
WPF	-	Wrapping Polyester Film
FC/T	-	Fixing C/T
FCEC	-	Fixing Copper End Cap
FBC	-	Fixing Base Cover
FCON	-	Fixing Connector
BAL	-	Ballast
BH	-	Bowl Holder

SCH	-	Spring Clip Holder
HP	-	Holder Plate
GH	-	Gasket Holder
BO	-	Body
BP	-	Ballast Plate
SP	-	Spigot
CGP	-	Control Gear Plate
RF	-	Reflector
SR	-	Spring Rod
SC	-	Spring Clip
SLA	-	Street Lantern Assembly
SL	-	Street Lantern
MP	-	Metal Plate
L&SH	-	Lamp & Starter Holder
STE	-	Starter
PVCW	-	PVC Wire
CAP	-	Capacitor
ML	-	Mirror Louver
CA	-	Components Assembly
MLA	-	Mirror Louver Assembly
RML	-	Recessed Mirror Louver Fitting
CR	-	Center Reflector
SR	-	Side Reflector
LAM	-	Lamella
SPD	-	Spring Device
AB	-	Angle Bracket
HD	-	Hanging Device
BOA	-	Body Assembly
TLA	-	Toshiba Louver Assembly
TML	-	Toshiba Mirror Louver

LSC	-	Lamp Casing Side Cover
LTRB	-	Lamp Casing Top Reflector Bracket
LTC	-	Lamp Casing Top Cover
LBO	-	Lamp Casing Body
LCA	-	Lamp Casing Assembly
LC	-	Lamp Casing
%	-	Percent
m	-	Meter
OEM	-	Original Equipment Manufacture
HM	-	Heavy Machine Department
ST	-	Stamping Machine Department
SW	-	Spot Welding Department
PC	-	Painting Conveyer Department
BA	-	Ballast Assembly Department
BV	-	Ballast Vanish Department
SLA	-	Street Lantern Assembly Department
MLA	-	Mirror Louver Assembly Department
LCA	-	Lamp Casing Assembly Department
TMLA	-	Toshiba Mirror Louver Assembly Department
PPM	-	Power Press Machine Department
MSD	-	Machine Work Shop Department
DDM	-	Deep Draw Department

CHAPTER 1
INTRODUCTION

1.1 Background

An inefficient facility layout has been hindering the efficiency of the operation and development of the manufacturing business in many years. It is due to the top management unaware of the important of efficient or optimal facility layout can bring the many benefits to its manufacturing operation in terms of cost, utilization of space, equipment, people, efficient flow of information, material, and employee safety. Generally, design of facility layout recognized as an important study in modern manufacturing system. An effective facility layout is depends on the layout of machinery and departments. It is determined by how to arrange the machines, and departments to achieve minimization or optimal of production time, material handling, so as to minimize the operation costs. Stevenson (2007) presented the basis reasons to invest in facility layout design, which are included require substantial investments of money and effort, long-term commitments, and cost efficiency of operation because rearrangement of the existing layout will costs large expense and hard to be accomplished. Therefore, an effective or optimal facility layout is required to reduce costs, thus increase productivity. An ineffective facility layout would cause serious consequences in manufacturing operation to prolong the time and cost flowing in operation. It contributes the movement of personal and material between facilities, and thereby increases the material handling cost, and also pulls down the efficiency of operation and productivity. "*companies will experience significant disadvantages when uncoordinated action plans*

are developed in an integrated facilities environment, and this usually results in higher capital expenditure, lower operational flexibility, higher operating costs, poor space and equipment utilization, reduced throughput, poor working conditions and a decline in productivity." (Gopalakrishnan et al. , 2004). Consequently, these companies been suffered by the bottleneck of development of new equipments or products due to limits on flexibility of utilization space, thus these companies will lost their competitive of its business in the globalization market.

Traditionally, there have two basic approaches to generate an effective or optimal facility layout. The two approaches are qualitative approach and the other is quantitative approach. The qualitative approach provides a layout based on the closeness rating between the departments. The quantitative approach generates minimization of the total material handling, workers, and information movement between the departments based on the interaction of the departments. Systematic Layout Planning (SLP) is a procedure based on an activity relationship chart and material flow analysis (Muther, 1973). "*The facility layout problem is often formulated as a quadratic assignment problem (QAP), which assigns n departments to n locations while minimizes the material handling costs.*" (Sha and Chen, 1999). Furthermore, there is not capable to solve the problem with 15 or more facilities optimally. Therefore, a heuristic approach is required to provide solutions for optimal arrangement. The heuristic approach is continuous improve the initial layout until the solution cannot be improved any further. Besides that, another approach to solve the problem is called algorithms. This approach assigns facilities to a location one by one until the complete layout is obtained. This assignment is based on closeness rating and proximity requirements. In recent years, the computer-based models have been developing many related computer software to assist to solve the facility layout problems. "*Computer-based models for the automatic generation of facility layouts have been shown to provide significant benefits to the industrial community for the planning and development of facilities*." (Gopalakrishnan et al. , 2004).

This project includes a study on a real-world case manufacturing factory to find the facility layout problems. Systematic Layout Planning (SLP) (Muther, 1973) is proposed to solve the layout design problems obtained from the manufacturing factory in order provide some recommendations for improvement for layout in this project. An analysis on the existing facility layout of the factory is then used to compare with the alternatives layout to find improvement.

1.2 Problem Statement

A company does not have a plan for a proper facility layout, it may not provide for the most effective and least cost use of men and machines. In consequences, the ineffective facility layout will increase the manufacturing operation costs such as material handling, processing time, and so on. Therefore, this project concerns with finding the alternatives by using SLP for arrangement of the facility layout that will allow smooth flow of the material with the minimization of material handling activities, and distance between the departments in order to reduce the cost of goods, save the processing time, and utilization of space.

1.3 Objectives

The objectives of this project are to:

1) Understand the current facility layout in a real-world case of a manufacturing industry.
2) Identify the facility layout problems in the factory.
3) Identify an alternative facility layout fitted for the problems by using SLP.
4) Analyze the facility layout and compare with alternatives.
5) Provide some recommendations for improvement.

1.4 Scope of Study

This project requires selecting a company and understanding the current facility layout. Observed and identify problems related to facility layout. Identify some alternatives, which may give better solution to exiting layout. This project included some data collection including the performance of the manufacturing system. The measurement will covers the actual sizes of the layout and the departments, activities between departments (material handling), distance between departments and materials flow between departments.

1.5 Organization of the Project

Chapter 1: Introduction, the first part of this project is an outline of the facility layout, problems statement, objectives and scope of this project.

Chapter 2: Literature review, summary of the important and nowadays journals, which are related to the topic of this project. This is followed by the discussion of the theories and approaches are required to solve the problems.

Chapter 3: Methodology, the materials and methodologies are determined to tackle the problems.

Chapter 4: Result, this chapter covered data tabulation and measurement of the existing condition derived from the facility layout and on-site measurements to the visited manufacturing factory. This is followed by the detailed calculation carried out for the problems, and then an analysis of the performance of the existing facility layout and the proposed alternatives is carried out in this chapter. The quantitative comparison between them is given in this project.

Chapter 5: Discussion, this chapter covered the priority area was the improvement for the facility layout and provided some recommendations for improvement.

Chapter 6: Summary and conclusion, finally, this project is concluded based on the objectives and result.